

DISCUSSION OF PESTICIDE ALTERNATIVES FOR MOSQUITO CONTROL IN MARICOPA COUNTY

Currently, Maricopa County is using an IMM (integrated mosquito management) approach to fight the breeding mosquito problem. This approach uses several methods to target all of the life stages for mosquitoes. The largest advantage to using an IMM is reducing the amount of chemical pesticides applied to an affected area. IMM uses the following tactics for mosquito control:

- Public education programs outlining the steps needed to keep mosquito populations down.
- Elimination of standing water where mosquitoes breed.
- Using larvicide and natural predators (gambusia) to control larval stages
- Fogging in areas of large adult mosquito populations.

From review of many citizens' complaints, it has been shown that controlling larval stages in green pools and other mosquito breeding sites will reduce populations of mosquitoes. The reduction of adult mosquitoes is evident by information collected through complaints. These pools and bodies of water are being treated with all four of the IMM tactics.

Maricopa County primarily utilizes Anvil, a synthetic pyrethroid, for fogging adult populations. Anvil is an EPA approved pesticide that has low environmental risk when applied as directed by the manufacturer's recommendations. The Centers for Disease Control (CDC) conducted a study in Virginia and North Carolina in 2003 exploring exposure to Anvil and Naled. The study revealed there was no significant amount of pesticide or metabolite in the urine of study participants after fogging. Other studies found that Anvil has a ½ life of up to 12 days in soil under normal usage conditions. It is rapidly degraded to non-toxic products in water and on contact surfaces when exposed to sunlight. When added directly to water, pyrethroids in general are very toxic to fish and marine invertebrates at low concentrations. This only occurs when tank rinsate is flushed into bodies of water.

In most formulations of pyrethrin pesticides a second, synergistic agent is added: piperonyl butoxide. The synergist blocks detoxication mechanisms and the pesticide becomes much more effective, reducing pesticide required by an order of magnitude to achieve the same result. There is little to no described difference in environmental effects from the synthetic vs. the natural pyrethrins; however, natural pyrethrins require a larger dose per area, and are more expensive because they are extracted from plants. Like their synthetic cousins, natural pyrethrin products have the piperonyl butoxide added to increase their effectiveness. Some of these "natural formulations" of pyrethrin are approved for and used in organic farming. It is also worth noting that pyrethrins are approved by the EPA and USDA for use on edible crops hours before harvest and processing.

There are only a few "natural" control methods for mosquitoes, and these mostly target larval stages. The *Bacillus thuringiensis* is a bacteria which causes a disease in the larvae of mosquitoes, but does not affect humans, pets or animals. Maricopa County currently

uses this method to control larvae. Gambusia, a predatory fish, are used to control larvae in pools of water and are also being used by the county as part of the IMM. The last natural predator of mosquito are bats that feed on adults. The success using bats to reduce adult mosquito populations has been mixed. Different regions and species of bats can have a significant impact on the success of this method.

Disadvantages to the use of bats include inability to rapidly deploy large numbers of animals; acquisition of special use permits; potential for increase in rabies; and bat feeding habits include other insects such as night pollinators.

Research has also shown there are other “natural” materials that can be used for mosquito control; these methods primarily rely on garlic extracts and other botanical extracts. The action is more akin to repellents but none are as effective as repellants containing DEET. The majority of these products are geared towards private use, and generally do not have approval by the EPA. Many of these “natural” products have received limited research to substantiate effectiveness in controlling mosquitoes, and are not subject to the same standards for registration and use that current, approved pesticides have. Unless a product is registered with the EPA for pesticide use, it would be illegal to use.

Included with this summary is a short table with some of the control methods used for mosquito abatement. There are three classes of synthetic chemical pesticides, pyrethrins, and organophosphates.

Malation is one of the organophosphate group of pesticides. Malathion is resistant to photolysis and has a short residual exposure to the air. When used according to the label, it degrades rapidly in the environment. Pyrethrin rapidly undergoes photolysis and hydrolysis; Pyrethrin is very tightly bound to soil particulates and is relatively immobile. Pyrethrin rapidly degrades into less toxic components. Malathion degrades to less toxic by-products also, but under certain environmental conditions seldom seen in Arizona, malation may break down and form more toxic components.

The toxicity to humans category uses rating nomenclature from the EPA toxicity rating scale, which is based on the LD50.

One of the following signal words will occur on each adulticide label (see *Applying Pesticides Correctly*, USDA/EPA, 1992):

CAUTION -- This word signals that the product is slightly toxic. An ounce to more than a pint taken by mouth could kill the average-size adult. Any product which is slightly toxic orally, dermally, or through inhalation or causes slight eye and skin irritation will be labeled “CAUTION”.

WARNING -- This word signals that the product is moderately toxic. As little as a teaspoonful to a tablespoonful by mouth could kill the average-size adult. Any product

which is moderately toxic orally, dermally, or through inhalation or causes moderate eye and skin irritation will be labeled “WARNING”.

DANGER – This word signals that the pesticide is highly toxic. A taste to a teaspoonful taken by mouth could kill an average-size adult. Any product which is highly toxic orally, dermally, or through inhalation or causes severe eye and skin burning will be labeled “DANGER”.

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Sources:

<http://extoxnet.orst.edu/pips>: Summary sheets containing toxicological data for individual pesticides

<http://www.epa.gov> Info on pesticides/ mosquito abatement

<http://npic.orst.edu/> Info on pesticides

<http://www.cdc.gov> Lots of info on WNV

<http://hclrss.demon.co.uk> Chemical structure and properties of pesticides

<http://www.pesticide.org>

<http://www.meepi.org>

<http://www.health.state.ny.us>

<http://www.astdr.cdc.org>

National Pesticide Telecommunications Network: LD 50 and ½ life data

Toxicology and Environmental Fate of Synthetic Pyrethroids. Mueller-Beilschmidt, Doria. Journal of Pesticide Reform. Vol. 10, NO. 3 pp 32-37

MSDS sheets provided by Anvil, Masterline Kontrol